

DISTRIBUTION OF NATIVE AND
INTRODUCED KNAPWEEDS (CENTAUREA)
IN CANADA AND THE UNITED STATES¹

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The genus *Centaurea* (family Compositae, tribe Cardueae) is a large and taxonomically complex group of at least 500 species, centered in the Mediterranean region. The great majority of species are Eurasiatic but two species are native to the southwestern United States and a few others are native in northern South America. A number of Old World species are naturalized, to varying degrees, in Canada and the United States.

During the course of studies of the species found in Canada, data concerning the genus in the United States have been brought together from the literature and from herbarium collections examined. Floras of various areas of the United States treat the species found in their range but there is no complete inventory of United States species. Moreover, there is obvious disagreement between authors regarding the nomenclature and taxonomy of certain species and uncertainty as to the occurrence of a few species in the country. Boivin (1966-67) has listed the species found in Canada and we have discussed the morphology and distribution of these species in a study of the tribe Cardueae (Moore and Frankton, 1972).

In the following key is given the diagnostic characters of the taxa which have been reported or have been found to occur in Canada and the United States. Brief notes regarding taxonomy, common synonymy and a summary of the distribution are added.

The identification and distribution of Canadian plants have been verified from herbarium collections, notably those of the following institutions: Department of Agriculture, Ottawa (DAO); National Museum of Canada (CAN); Montreal Botanic Garden (MTJB); Botanical Institute, University of Montreal (MT); University of Brit-

¹Contribution no. 892 of the Plant Research Institute.

ish Columbia (UBC); British Columbia Provincial Museum, Victoria (V). Information regarding United States species has been compiled from the commonly known recent floras, some of which are cited here, and from herbarium specimens examined in the course of studies of the Cardueae of Canada. Specimens have been borrowed from the Gray Herbarium of Harvard University (GH), New York Botanical Garden (NY), and the University of Vermont (VT) to resolve certain specific problems. Verification of United States records which appear to be credible has not been attempted. The various North American introductions have been compared with European specimens of the taxa in our herbarium (DAO). Specimens of all the taxa discussed here have been seen, but in the cases of a few rarer species (*C. eriophora*, *C. diluta*, *C. nervosa*) only Old World specimens were available for study.

Since most of the species are adequately described in available floras, descriptive comments are here appended only in cases where there is disagreement with the concepts expressed by most authors or to emphasize points of distinction between species.

The genus *Centaurea* is here treated *sensu lato*, as is the most common practice in North America. As indicated by synonymy, some of the species are often placed in segregate genera.

DESCRIPTIVE CHARACTERS

Some discussion of the characters used in the following key may be helpful. The phyllaries (involucral bracts) take many forms in the genus and are very useful as diagnostic characters since they are present and easily examined in all flowering specimens. The innermost row of phyllaries is frequently unlike the outer rows and descriptions here refer to the more conspicuous outer 2 or 3 rows, unless otherwise stated. An apical spine is considered to be a rigid pointed apical structure that is distinctly longer than any lateral points that may be present on the phyllary. Phyllary margins (as distinct from the phyllary

apex) may also bear spines, which are pointed rigid structures, unlike the wiry, more or less flexible marginal processes seen in the condition described as pectinate, or the serrations of membranaceous or chartaceous margins. In many species the apical portion of the phyllary is expanded into a structure (appendage) that is distinctly broader than the phyllary base (blade). In our species the appendage is either pectinate or chartaceous and with entire or lacerate margins. The flower heads may consist wholly of perfect tubular florets, all similar in size, or of shorter, perfect central florets surrounded by a peripheral row of longer, sterile tubular florets, which simulate ray florets. In the key, these conditions are described as eradiate (all florets similar) or radiate (short central and longer peripheral florets — actually a falsely-radiate condition).

KEY TO SPECIES

- a. Outer and mid involucrel phyllaries terminated by a distinct spine (very short in *C. salmantica* and *C. diluta*); with or without marginal spines as well. (b)
 - b. Marginal spines or processes absent. (c)
 - c. Apical spines more than 5 mm long (usually 10-25 mm). (d)
 - d. Stems winged (decurrent leaf bases); flowers yellow (Sect. *Mesocentron* DC.) (e)
 - e. Apical spines pinnately spinose (bearing several lateral spinules on the shaft); phyllaries arachnoid. (f)
 - f. Apical spines 5-10 mm long; involucre about 15 mm high 1. *C. melitensis*
 - f. Apical spines more than 10 mm long; involucre approx. 20 mm high 2. *C. eriophora*
- e. Apical spine palmately spinose (without spinules on the shaft but with 2-5 pairs of palmately arranged basal spinules); phyllaries glabrous. (g)
 - g. Heads 35-40 mm high, involucre 20-

- 25 mm high, 15 mm broad; tips of inner phyllaries not dilated; achenes approx. 4.5×3 mm; pappus dark brown 3. *C. sulphurea*
- g. Heads 20 mm high, involucre 15 mm high, 10 mm broad; tips of inner phyllaries chartaceous and dilated; achenes approx. 3×1.5 mm; pappus white 4. *C. solstitialis*
- d. Stems not winged; flowers pink to purple (Sect. *Calcitrapa* Cass.). (h)
- h. Involucres longer than broad (length 12-17 mm; L/W approx. 2.5); heads sessile or subsessile; pappus absent 5. *C. calcitrapa*
- h. Involucre globular, about as long as broad (length 11-14 mm); heads pedicellate (pedicels 10-50 mm long); pappus about 2 mm long 6. *C. iberica*
- c. Apical spines 1-5 mm long (i)
- i. Apical spines 3-5 mm; phyllaries sericeous, margin dark pigmented 7. *C. muricata*
- i. Apical spines 1-2 mm; phyllaries glabrate, margins not pigmented. (j)
- j. Phyllary tips dark, terminated by a 1 mm spine or sometimes merely mucronate; margin entire 8. *C. salmantica*
- j. Phyllary tips not pigmented, with a 1-2 mm spine and a small chartaceous, palmate-lacerate appendage; margin narrowly scarious 9. *C. diluta*
- b. Marginal spines or processes (at least 4 pairs) present, in addition to the apical spine (Sect. *Acrolophus* Cass.) (k)
- k. Heads radiate (but peripheral florets only slightly larger than the inner florets); marginal processes straight or curved and somewhat flexible,

phyllary tip and margin pigmented, forming a dark V-shaped mark. (l)

- l. Involucres 6-8 mm broad, globose and rounded at the base; heads borne in corymbs or corymbose panicles, the branches not strikingly straight and stiff in appearance . . .

..... 10. *C. maculosa*

- l. Involucre 4-6 mm broad, distinctly longer than broad and the base usually tapering; heads borne in panicles on stiffly diverging branches

..... 11. *C. paniculata*

- k. Heads eradiate; marginal spines straight and stiff, phyllary margins not pigmented in a V-shaped marking but occasionally with a dark irregular apical mark. (m)

- m. Heads 14-16 mm high; achenes 2.3-2.5 mm long, pappus absent or short (1 mm); flowers usually white but sometimes yellow, pink or mauve

..... 12. *C. diffusa*

- m. Heads 12-13 mm high; achenes 2.5-3 mm long; pappus present (to 2.5 mm); flowers pink or mauve

..... 13. *C. virgata* var. *squarrosa*

- a. Outer phyllaries not terminated by a conspicuous, stiff spine which is longer and more prominent than any marginal processes (margins pectinate, lacerate or entire) (n)

- n. Phyllaries bearing an apical appendage (an abrupt expansion of the phyllary blade, broader than the base of the blade) (o)

- o. Heads small (to 4 cm broad) (p)

- p. Involucres approximately as long as broad; phyllary appendages broad and completely covering the bases of adjacent phyllaries (q)

- q. Appendages brown and papery, with lacerate margins

..... 14. *C. jacea*

- q. At least some of the appendages pectinate

- (wiry marginal processes), appendages black or dark brown (r)
- r. Apex of appendages extended into a very long, recurved process and with numerous long lateral processes, feather-like in appearance (s)
- s. Plants rarely branched, bases of upper leaves truncate and almost clasping; involucre 20-24 mm high; achenes 4-5 mm, pappus 2.5-3 mm long 15. *C. nervosa*
- s. Plants usually branched; leaf bases tapering; involucre about 15 mm long; achenes 3-3.5 mm long, pappus 1 mm 16. *C. austriaca*
- r. Apex of appendages appressed and not extended into a long recurved tip (t)
- t. Heads eradiate; pappus present (short, 0.5 mm but fully developed); appendages black, wiry processes long, 2-3 × width of the blade, completely covering the adjacent phyllaries 17. *C. nigra*
- t. Heads eradiate or radiate; pappus absent or vestigial (few short bristles); appendages brown (not dark brown) and variable from pectinate to chartaceous-lacerate, appendages broad, covering adjacent phyllaries
 18. *C. × pratensis*
- p. Involucre longer than broad ($L/W = 1.5$); phyllary appendages smaller and not completely obscuring adjacent phyllaries (u)
- u. Appendages black or dark brown, small and usually triangular, not concealing the contrasting green phyllary blades; rameal

- leaves narrow and smaller than the cauline leaves 19. *C. nigrescens*
- u. Appendages dark brown, to twice the width of the phyllary base and almost covering adjacent phyllary bases; rameal leaves not clearly differing in size from the cauline leaves 20. *C. dubia*
- o. Heads large (over 4 cm broad) (v)
- v. Phyllary appendages chartaceous and palmately lacerate; heads eradiate, flowers yellow 21. *C. macrocephala*
- v. Appendages pinnately pectinate; heads radiate, flowers purplish (w)
- w. Phyllaries brown, appendages bearing 8-12 pairs of cilia 22. *C. rothrockii*
- w. Phyllaries straw-colored and sometimes purple-tinged, appendages bearing 3-8 pairs of cilia 23. *C. americana*
- n. Phyllaries lacking an apical appendage (x)
- x. Phyllary margins papery, either entire or lacerate but not pectinate (y)
- y. Phyllary margins essentially entire, not lacerate (z)
- z. Heads to 2 cm high, eradiate . . 24. *C. repens*
- z. Heads to 4 cm high, radiate . 25. *C. moschata*
- y. Phyllary margins regularly dentate-lacerate (aa) (Sect. *Cyanus* DC.)
- aa. Leaves elliptic, oblanceolate, 10 mm or more wide; heads over 3 cm broad 26. *C. montana*
- aa. Leaves linear, lanceolate, to 3 mm wide; heads to 3 cm broad . . . 27. *C. cyanus*
- x. Phyllaries pectinate (with wiry marginal processes) (Sect. *Lopholoma* Cass.) (bb)
- bb. Heads eradiate; foliage hoary 28. *C. cineraria*
- bb. Heads radiate; foliage glabrous 29. *C. scabiosa*

NOTES ON SPECIES AND THEIR DISTRIBUTION

1. *C. melitensis* L. Maltese Centaury, Tocalote, Croix de Malte; common: U. S. — west coast, Ariz., N. M., Texas, established in the western states, occasional and perhaps not persisting in the central and eastern states (Steyermark, 1963; Fernald, 1950); Canada — Vancouver Is., B. C.
2. *C. eriophora* L. Rare: U. S. — Cal. Only one 1909 collection from Los Angeles is reported (Howell, 1959).
3. *C. sulphurea* Willd. (*C. sicula* of Cal. authors, according to Howell (1959); rare: U. S. — Cal.
4. *C. solstitialis* L. Barnaby's Thistle, Yellow Star-thistle, Centaurée du Solstice; common: U. S. — probably in all states, weedy in the southwest; Canada — sw Ont., Man., Sask.
5. *C. calcitrapa* L. Purple Star-thistle, Caltrope; common: U. S. — southeastern states to N. Y. (Fernald, 1950), west coast (Abrams & Ferris, 1960), Ariz. (Howell, 1959), Ill. (Jones & Fuller, 1955); Canada — sw Ont., Vancouver Is., B. C.

Howell (1959) records that a similar plant, possibly to be called *C. calcitrapoides* L., had been collected in Riverside Co., Cal. We have a collection from Humboldt Co., Cal. (*Tracy* 16769 — DAO) which may be *C. calcitrapoides*, since a sparse pappus is present. This species differs from *C. calcitrapa* in the taller habit and the presence of a short pappus.

6. *C. iberica* Trev. in Spreng. Iberian Star-thistle; rare?: U. S. — Cal. Howell (1959) reports this species as rare in 3 counties of Cal., first collected in 1924. Several west coast floras list it for Cal. only.

This species is similar to *C. calcitrapa* and specimens identified as *C. calcitrapa* may be *C. iberica*. Two such cases have been revised: Soil Conservation Col-

lection, Sept. 10, 1955, Converse Co., Wyo. — DAO; *Jones s.n.*, July 13, 1946, Labette Co., Kans. — DAO). To our knowledge, *C. iberica* has not been reported in Kansas or Wyoming. Iberian Star-thistle may occur in states other than California, in ranges reported for *C. calcitrapa*.

7. *C. muricata* L. (*Amberboa muricata* (L.) DC., *Voluntarella muricata* (L.) Benth. & Hook.); rare: U. S. — Santa Barbara, Cal.
8. *C. salmantica* L. (*Microlonchus salmanticus* (L.) DC., *Mantisalea salmantica* (L.) Briq. & Cavill.); rare: U. S. — Cal. (Howell, 1959), Ariz., (Kearney & Peebles, 1960)
9. *C. diluta* Ait. Rare: U. S. — Cal.
10. *C. maculosa* Lam. Spotted Knapweed, Centaurée; common: U. S. — all states except possibly the southeastern; Canada — N. S., N. B., Que., Ont., B. C. The plant is a serious weed in some areas, forming infestations.

This taxon is treated in many different ways by European authors. Some take up the prior name *C. stoebe* L., which may or may not apply. Others treat *maculosa* as a variety of *C. paniculata* or divide *maculosa* into three subspecies, which by other authors, are raised to species.

Among North American collections the ssp. *micranthos* (Gmel.) Gugler is distinguished by smaller heads (involucre 10-11 mm high) and fewer (4-6 pairs) and shorter phyllary processes and by the black or brown pigmentation of the phyllary margin and processes, contrasting with the green blade. The ssp. *rhenana* (Bor.) Gugler and ssp. *maculosa* have larger heads (involucre 11-14 mm) and 5-10 pairs of longer marginal processes which are black — dark brown in *rhenana* but brown and partially white in the typical subspecies.

11. *C. paniculata* L. Rare: Canada Vancouver Is., B. C.
This species is similar to *C. maculosa* and there has been dispute whether these B. C. plants are *paniculata* or *maculosa*. Howell (1959) has restored *C. paniculata* to the B. C. Flora and his decision seems to be justified.
12. *C. diffusa* Lam. Tumble Knapweed; common: U. S. — apparently widespread in the north, above 40°, probably common in western states and occasional elsewhere; Canada — Alta., B. C.
13. *C. virgata* Lam. var. *squarrosa* (Willd.) Boiss. (*C. squarrosa* Willd.); rare: U. S. — Cal., Utah (Howell, 1959).
14. *C. jacea* L. Brown Knapweed; common: U. S. — widely reported for northeastern and west coast states, probably midwest also; Canada — Que., Ont., B. C.
Specimens of *C. pratensis* (*nigra* × *jacea*) are frequently identified as *C. jacea*. Probably both of these occur within the range commonly stated for *C. jacea*. Phyllary appendages are brown, chartaceous and entire or subentire but not deeply lacerate as in the hybrids. Heads are radiate.
15. *C. nervosa* Willd.
Not known to occur in Canada or U. S. This species has been reported only by Fernald (1950) from one collection (*Burnham*, July 30, 1916, margin of grain-field, east of lower falls, N. Beaver Creek, Vaughns, north of Hudson Falls, Washington Co., N. Y. — GH!). We have revised this specimen to *C. austriaca*.
Plants of *C. nervosa* are 10-40 cm tall, usually unbranched, with a single head, the stem leafy to the top; lower leaves oblanceolate, base tapering, middle and upper leaves oblong, base truncate or shallowly clasping; involucre 20-24 mm high; phyllaries lanceolate to 2 cm long, recurved, plumose, black or dark brown.

16. *C. austriaca* Willd. (*C. phrygia* ssp. *austriaca* (Willd.) Gugler); rare: U. S. — N. Y., Vt., O.

This species has been reported only by Seymour (1969) on the basis of a collection from Dorset, Bennington Co., Vt. (*Gilbert s.n.*, Sept. 22, 1966 — VT!). We agree with this identification. This collection and that of Burnham (see *C. nervosa*) are from adjacent counties of New York and Vermont, from locations approximately 25 miles apart. Gilbert notes that the plants had persisted near farm buildings for several years but did not seem to mature seed. However, it seems that the introduction has survived for half a century in this area. An additional collection, probably this species, from Ohio (*Webb* 1525, Sept. 18, 1921, Portage Co., O. — GH!) has been seen.

These plants are 15-80 cm tall, branched and bearing many heads per plant; cauline leaves narrow, upper leaves not clasping the stem; heads smaller than in *C. nervosa*, ovate, approximately 14 × 16 mm; inner phyllaries rounded at tip, middle and outer phyllaries long and plumose, black or dark brown, recurved.

17. *C. nigra* L. Black Knapweed, Centaurée noire; (*C. jacea* var. *nigra* Briq., *C. consimilis* sensu Piper & Beattie, Flora Southeastern Washington, 1914); common: U. S. — widespread in the northern states, probably south to about 37° N; Canada — Nfld., P.E.I., N. S., N. B., Que., Ont., B. C.

The type specimen of *C. nigra* has eradiate heads (Marsden-Jones & Turrill, 1954) and it seems that plants that are typical in other characters as well are always eradiate. Descriptions and illustrations in some floras indicate that *C. nigra* may have radiate or eradiate heads. The radiate plants are, in our opinion, *C. × pratensis*, a hybrid between *jacea* and *nigra* which is highly variable and sometimes closely approaches the parental species.

In typical *C. nigra* the phyllary appendages are

black (not dark brown), the wiry cilia very long, almost matted, covering adjacent phyllaries. A white-flowered form (*C. nigra* f. *pallens* Spenn) has been collected in N. S. and Que., Canada.

18. *C. × pratensis* Thuill. Protean Knapweed; common: U. S. — probably throughout the ranges reported for *C. nigra* and *C. jacea* (northern states); Canada — N. S., Que., Ont., B. C.

This is a hybrid between *C. nigra* and *C. jacea* and is apparently included in the description of *C. nigra* in some floras. Abrams & Ferris (1960) and Howell (1959) report the occurrence of the species on the west coast of U.S.A. Specimens from Mass., Me., N. Y., Pa., R. I., Vt., (GH, VT) have been examined in this study.

This hybrid shows great variation in the form of the phyllary appendage: wiry and pectinate, dark brown but not black, cilia long and covering adjacent phyllaries; some appendages pectinate and others partly pectinate and partly chartaceous-lacerate and showing many intermediate conditions between pectinate (*nigra* character) and chartaceous (*jacea* character); sometimes all chartaceous and subentire. Thus the appendage form may closely approach those of the typical parent species but usually shows some evidence of an intermediate condition. Heads are usually radiate but may be eradiate in specimens which closely approach *C. nigra*.

19. *C. nigrescens* Willd. Short-fringed Knapweed; (*C. vochinensis* Bernh., *C. transalpina* Schleicher p.p.); common: U. S. — probably widespread in the northern states; Canada — N. S., Que., Ont., B. C.

Kerner (1881, pp. 81-85) selected the type of *C. nigrescens* in Willdenow's herbarium and found it to be the same as the later-described *C. vochinensis*. Many U. S. floras recognize *C. vochinensis*, some take up *C. nigrescens* and a few list both species. Appar-

ently *C. dubia* is included. There is confusion in the application of these names. Collections of *C. nigrescens* from Conn., D.C., Ind., Mo., N. J., N. Y., Neb., Ore., Pa., Va., Wisc., (DAO, GH, NY) and from the above-listed provinces of Canada have been seen.

The heads separate *C. nigrescens* from the generally similar *C. nigra*. The involucre of *C. nigrescens* is longer than broad and the small, triangular, black, short-fringed appendages contrast strongly with the green phyllary blades which are not covered by the appendages. The upper (branch) leaves tend to be noticeably smaller than the lower leaves. Heads of this species and of *C. dubia* are usually eradiate.

20. *C. dubia* Suter (*C. nigrescens* Willd. *p.p.*, *C. transalpina* Schleicher *s. str.*, *C. jacea* var. *transalpina* Briq., *C. dubia* ssp. *eu-dubia* (Suter) Gugler & Thellung, *C. nigrescens* var. *dubia* Hermann); common: U. S. — Mass., N. J., N. Y., O., Ore., Va., Vt.

According to Cronquist (1955; Gleason & Cronquist, 1963) who is the only author to recognize *C. dubia* in North America, the species is widely established in northeastern United States and southeastern Canada and occasional in northwestern U.S.A. We have seen specimens (NY, GH) from the above states; none from Canada are known. The species is closely related to *C. nigrescens* and it is difficult to separate some specimens.

These plants are similar to *C. nigrescens* but the phyllary appendages have longer cilia which almost, and sometimes completely, cover the adjacent phyllary bases. There is no distinct difference in size between upper and lower leaves and the latter may tend to be broader.

21. *C. macrocephala* Puschk. in Willd. Rare: Canada — Que., a casual adventive from cultivation, probably not persisting (Moore & Frankton, 1972).

22. *C. rothrockii* Greenm. Native species: U. S.: — sw N. M., se Ariz.
23. *C. americana* Nutt. Native species: U. S. — Ark. & Ia. to Ariz., occasionally an escape from cultivation in the northeast.

24. *C. repens* L. Russian Knapweed; (*C. picris* Pall., *Acroptilon repens* (L.) DC., *A. picris* (Pall.) Boiss.); common: U. S. — reported in all states except the southeastern; Canada — Ont., Man., Sask., Alta., B. C.

This species is frequently a serious weed in our area. There is cytological and morphological justification for segregating this species as *Acroptilon repens*.

25. *C. moschata* L. Sweet Sultan; (*Amberboa moschata* (L.) DC.); rare: U. S. — northeast, Ill., Cal.; Canada — Vancouver Is., B. C.

This garden escape seems to persist in the northern states but is never common.

26. *C. montana* L. Mountain Bluet; rare: Canada — Nfld., N. B., Que., Ont., B. C.

Gleason & Cronquist (1963) state that this species is a rare escape in the northern part of the range of their flora (northeastern states and adjacent Canada).

27. *C. cyanus* L. Bluebottle, Cornflower, Barbeau, Casse lunette; (*Leucacantha cyanus* Nwd. & Lunnel, *Cyanus segetum* Bauh.); common: U. S. — probably all states: Canada — all provinces except Sask.

This garden escape is reported in all regions. The variety *denudata* Suksdorf, reported for Wash., is a less pubescent variant.

28. *C. cineraria* L. Dusty Miller; rare: U. S. — Cal.
29. *C. scabiosa* L. Greater Centaurea, Hardheads, Centaurée scabieuse; rare: U. S. — O., Ia., Mont., Canada — Que., s. Ont.

This escape is apparently not widely established; it

is mentioned for only three states by several floras. The reported occurrence in N. B., Canada (Boivin, 1966-67) is an error due to a mislabelled specimen (Boivin, personal comm.).

SUMMARY

Twenty-six introduced and two native species of *Centaurea* are known to occur in the area Canada-United States. Sixteen of the adventive species are found in Canada and three of these in Canada alone. An additional ten introduced and two native species occur in the United States, making a total of 23 introduced and two native species in that country.

Probably eleven of the introduced species can be classed as widespread: *C. solstitialis*, *C. calcitrapa*, *C. maculosa*, *C. diffusa*, *C. jacea*, *C. nigra*, *C. × pratensis*, *C. repens*, *C. cyanus* and perhaps *C. nigrescens* and *C. dubia*. With the exception of the last, these species are known from both countries and generally the ranges are continuous, although more extensive in the United States. A number of the rarer species are known only in the southwestern states, notably California.

Five species (*C. diffusa*, *C. jacea*, *C. maculosa*, *C. nigra*, *C. repens*) are regarded as weeds in Canada (Frankton & Mulligan, 1970), *C. repens* being the most serious. Russian Knapweed has been reported to cause sheep and horse poisoning in the Old World and *C. repens* and *C. solstitialis* have recently been shown (Young, Brown & Klinger, 1970) to cause Chewing Disease in horses in the western United States.

ACKNOWLEDGEMENTS

Appreciation is expressed to the curators of herbaria who have made their collections available for study.

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